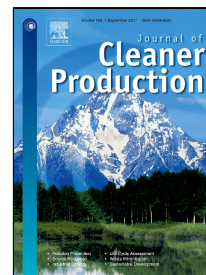


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Analyzing Factors Affecting Implementation Success of Sustainable Human Resource Management (SHRM) using a Hybrid Approach of FAHP and Type-2 Fuzzy DEMATEL



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**Analyzing Factors Affecting Implementation Success of Sustainable Human
Resource Management (SHRM) using a Hybrid Approach of FAHP and Type-2
Fuzzy DEMATEL**

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Abstract

Organizations' attention paid to community and environment, and also awareness of the effects of environmental variables has contributed to the development of the concept of sustainability in organizations. Various factors including human resources can be used in the analysis of sustainability of organizations, but the issue has not been seriously considered by researchers, and the link between sustainability and human resource management and related studies have not still been extensively developed in all the branches of human resource management. One of the reasons for this issue is failure to identify the factors influencing human resource management sustainability in organizations. The current article seeks to identify these factors. Based on the existing theoretical foundations and the use of experts' opinions, the factors affecting the implementation of human resource management were divided into three categories including economic, social and environmental dimensions. To determine the weight of the factors identified based on the lack of independence of the

factors; Fuzzy AHP and Fuzzy Type-2 DEMATEL were applied. The results indicated that environmental dimension was one of the effective factors and was considered the cause; however, social and economic dimensions were affected and considered the effects. Environmental factors were the most important ones.

Keywords: Sustainability, Sustainable Human Resource Management, Type-2 Fuzzy

1. Introduction

In 1987, Brundtland Commission expressed sustainability as an important element in economic growth. More recently, the business world has found a strong interest in company sustainability and social responsibility (Ehnert, 2009a). Also, the companies to increase its cleaner production have focused their attention towards sustainability (Severo et al., 2015). In the past two decades there has been a growing interest towards sustainability, and the result is a parallel growth in the area of sustainable practices (Delmas and Blass, 2010). Some issues such as environmental degradation, marginalization of a considerable number of social groups, protests against capitalism, and the search for innovation and creativity in public and private sector and cleaner production have caused that the debate about global issues and corporate sustainability to become a priority of organizational and global issues (Jabbour and Santos, 2008; Shin et al., 2008). Cleaner productions are seeking to optimize usage of resources, reduce waste and achieve sustainability (Severo et al., 2015). On the other, some research, like Shin, Curtis, Huisingh and Zwetsloot (2008), are seeking to offer models to achieve cleaner production through sustainability (Shin et al., 2008). Therefore, it can be said that sustainability and cleaner production have mutual relationship to each other (Severo et al., 2015; Shin et al., 2008). Another factor that plays an important role in sustainability of organizations, is human resource management (Van Marrewijk, 2003). However, the issue has been of less interest for the researchers, and the link between sustainability and human

resource management and relevant studies have not still been widely used in all the branches of human resource management, and diverse interpretations have been presented on sustainability, and the issue is less linked to human resource management (Ehnert, 2006; Zoogah, 2011). Nevertheless, studies have shown that the presence of sustainability and its relevant dimensions in the organization can lead to the further commitment of employees and an improvement in human resources (Ehnert, 2009b; Pipoli et al., 2014). As all of the advances and technology achieved in the history of mankind is the product of human creativity and innovation, it can be said that the real wealth of any organization is its human resources (Pohjola, 2001). Thus, human resource sustainability will lead to the sustainability of resources in an organization. To maintain its social legitimacy, the organization is required to use its own current and potential human resources, and this is a sign of the sustainable use of human resources (Ehnert, 2009a). To reduce expenses, some organizations have attempted to downsize the employees and to sacrifice workforce (Kaye, 1998; Laabs, 1999; Mariappanadar, 2003). This represents organizations' irresponsible social use of organizational human resources. Most researchers practicing in the area of human resource management believe that the capabilities and activities in the field of human resource management can lead to high performance in an organization, and this contributes to organization sustainability in some issues such as competitive advantage, such that the organizations that have established their position properly take privilege of a superior competitive advantage than the competitors (Khorasani et al., 2007; Ramlall, 2006). In recent years, to maintain their sustainably, organizations have used some facilitators in the area of human resources such as keeping a balance between work and life to be able to preserve their human resources and talents, and significantly increased the productivity of their human resources (Garavan et al., 2012; Ojo et al., 2014; Ruth Eikhof et al., 2007). Nevertheless, some studies have been conducted concerned with the factors affecting the sustainability of

HR like, (Ehnert, 2009c; Kramar and Mariappanadar, 2015). These studies have focused on environmental sections and have not paid attention to the economic and social dimensions of HR sustainability. Therefore, this research aimed to investigate three sustainability factors in order to identify, weight, and determine the cause-effect relationships of factors affecting HR sustainability in organizations.

2. Research Literature

2.1. Human Resource Management (HRM)

Few persons can be found that have not encountered the phenomenon of human resource management, and the importance of this part of the organization is its role in optimizing expenses and improving productivity and quality (Cho et al., 2006). Mary Parker Follett (1926) as one of the first theorists of human relations alleged that preliminary theories proposed in the area of management are incomplete because of lack of attention to human relationship, and he also expressed the fact that the influential factor on the efficiency of an organization is coherent relations between managers and employees, and if management works along with employee (rather than imposing mere supervision), better results can be achieved, and humanitarian dimension of an organization is as significant as its technical one (Delaney and Huselid, 1996; Follett, 1924; Kalleberg and Moody, 1994). With rising demand and providing services by organizations and also different environmental changes, human resources that can accomplish organizational goals and missions have found a more prominent position (Becker and Gerhart, 1996; Carnevale, 2003; Denhardt and Denhardt, 2007). As the technology has lost its inimitable properties and it cannot not act as a competitive advantage any longer due to the excessive expansion of information and knowledge age, and human resource is a pillar of the organization's competitive advantage, superior human resources facilitate the superiority of organizations over their leading

competitors (Phipps et al., 2013). Change in this paradigm and highlighted importance of human resources have created challenges for human resource management, and this has led to more flexibility in confrontation with demands and expectations, and also an investigation of the status of human resources has been of more significance (Lok and Crawford, 2000). Now, if human resource management is not institutionalized in the organization, organizational performance and social capital cannot be realized, and enormous costs can be imposed on the organization. Thus, human resource management upgrades organizational performance and efficiency, and then brings about efficiency and profitability (Becker and Gerhart, 1996). Undoubtedly, famous and powerful organizations are aware of the effective role of human resources in increasing growth and development, and prudent and far-sighted managers consider an organization as a combination of employees with different moods and thoughts, knowledge, and different physical conditions, and organizations without them cannot ever find an external existence.

2.2. Sustainability

Many policy makers, practitioners and researchers have defined sustainability synonymous with concepts such as “prolonged time” “durability”, and “stability” (Leal Filho, 2000). On the other hand, many researchers such as Sun Wei and Van Jay (2010), Shin et al. (2011), Diaz (2011), Dempsey et al (2012), Zehang Bopo et al. (2012), and Agbazi (2013) have performed some research on sustainability. However, the concept of sustainability is still complex and obscure, and most of the researches performed in this area have failed to present a precise definition (Docherty et al, 2002; Ehnert, 2006). The concept of sustainability was first proposed by an active movement in the area of environment (Daly, 1973) and it has become a mantra of the world in the 21st century (Dyllick and Hockerts, 2002). The main reason underlying the popularity of “sustainability and sustainable development” is related to

the definition presented by the International Commission for the Environment called Brundtland Commission (WCED). In this definition, it is stated that “Sustainable development is development that fulfills all needs and requirements of the present generation without endangering the ability of future generations” (Hinrichsen, 1987). Based on this definition, before any society could achieve sustainability, it must guarantee inter- and intra-generational equity (Gladwin et al., 1995). Given that organizations attach more significance to sustainability and success in today’s business market, Global Standards Organization (GSO) presented a pattern for organization sustainability management to clarify management standards (ISO/CD9004:2007). This standard states that the sustainability of an organization depends on the exploration of external environment for opportunities, changes, trends and risks involved and the balance between economic, social and environmental arenas in an organization (ISO/CD9004:2007).

2.3. Sustainable human resource management

Brundtland Commission asserts that sustainability can accomplish relevant objectives at three levels including economic, environmental and social, without endangering natural life conditions (Ehnert, 2009b; Hinrichsen, 1987). Since sustainability has three levels including environmental, social, and economic, the factors affecting human resource sustainability should also be discussed in the three dimensions (Melorose et al., 2015). Since the research aimed to identify the factors affecting the HR sustainability, dimensions are explained as follows.

2.3.1. Social Sustainability

This type of sustainability refers to maintaining and improving the welfare of current and future generations (Chiu, 2003), and creates a harmonious living environment and

improvement in quality of life, and it can also destroy social gap and inequality (Enyedi, 2002). In this regard, some of the important factors in implementing social sustainability of human resources are as follows:

Social infrastructure: including employee's basic needs such as therapeutic centers, sports facilities, social centers, providing halls for leisure activities, taking into account vulnerable groups of society such as the disabled and the elderly and children, green and open spaces, and providing amenities, quality of life and welfare, associations and cultural traditions (Ahmad and Schroeder, 2002; Chan and Lee, 2008).

The availability of career opportunities: employment is the main locus of social sustainability, and in addition to income, people can feel social welfare through interaction with others. Steglitz (2001) showed that unemployment increased divorce, suicide, alcoholism, and with an increase in employment, a reduction can be seen in poverty, social exclusion and mental health problems (Chan and Lee, 2008; Omann and Spangenberg, 2002).

Accessibility: access is an essential topic in social sustainability. People like to have convenient access to their desired places, or prefer to take advantage of a workplace, residence, and entertainment venue in close proximity to each other, so urbanization is an important determinant of access (Smith, 2000; Yeh and Ng, 2000).

Ability to fulfill the psychological needs: security is a very important element in society, and people prefer to live in safe places. In addition, safety, a sense of community, and sense of belonging are also some dimensions of psychological needs (Ahmad and Schroeder, 2002; Chan and Lee, 2008; Omann and Spangenberg, 2002; Turkington and Sangster, 2006).

Social justice: a community is fair in which there is no age discrimination and racism and inter- and intra-generational justice is met in that community. Two of the dimensions of social justice are eradication of social exclusion and equitable distribution of income (Dempsey et al., 2011).

Social sustainability design: this factor includes education and training, affordable housing, public services, green space, culture and leisure, access to affordable housing, attractive public realm, the quality of the environment, sustainable urban design, all of which directly or indirectly influence social environment (Bramley et al., 2009; Dempsey et al., 2011).

Social sustainability: this factor includes social cohesion, social interaction and social networks, social capital, cohesion and harmony between different social groups and social order (Bramley et al., 2009; Dempsey et al., 2011; Littig and Griessler, 2005).

Corporate social responsibility: (Peneda Saraiva and Silva Serrasqueiro, 2007; Teck Hui, 2008).

2.3.2. Environmental sustainability

This type of sustainability creates a safe and nice environment and seeks to reduce environmental impacts and to restore environmental damage. On the other hand, movement towards sustainable development requires solving environmental problems (Randolph, 2004). Organizations should consider a set of procedures and policies for systematic management and continual improvement of environmental performance. In this regard, some of the important factors in the implementation of environmental sustainability of human resources are presented as follows.

Green job design: in general, green job design can be applied to determine and explain the number of jobs that protect the environment. Today, some organizations have integrated environmental and social tasks into a single job to protect the environment. The function of some of these jobs is to protect the environment, and some others revolve around accountability. Some organizations also use team work as job design techniques to examine environmental issues successfully. As a result, these jobs require multidisciplinary skills and

vast expertise. The organizations design these jobs based on an organization's environmental dimensions (Arulrajah, 2015).

Green human resource planning: Nowadays, organizations that predict the number and species of human resources are required to take some actions relevant to environmental management such as ISO 14001, green product, and accountability. These measures can guide organizations to manage environmental issues. Environmental management practices require a range of jobs and skills. The role of human resource management is essential in this regard. Using strategic decision making, some organizations predict environmental issues using consultants and environmental assessments. According to the available literature, there is no specific task for planning on human resource management. However, based on the experiences of different organizations and industries, some actions have been recognized in this regard (Arulrajah, 2015; Han et al., 2013).

Green employment: in recruiting green employees, the organization needs people who pay serious attention to environmental culture (Ahmad and Nisar, 2015; Mandip, 2012; Prasad, 2013; Road and Kingdom, 2013). Regarding environmental issues, organizations have their own frameworks, and to implement green policy in an organization, the employees are required that have a green orientation (Cherian and Jacob, 2012; Prasad, 2013). To develop environmental employees, organization has two options: focus on green employment and create awareness, and education about environmental protection. The first option is more cost-effective than the second one. Hence, the use of best practices for green employment is important to an organization (Arulrajah, 2015). Employment activities can protect environmental management through providing the new employees with environmental culture trainings (Han et al., 2013; Jackson et al., 2011). To implement green employment, organizations combine the organization's employment policies with environmental issues (Ahmad and Nisar, 2015; Cherian and Jacob, 2012). On the other hand, employees seek to

work in organizations that meet environmental considerations. If organizations are known as green employer, they would be able to attract more talent. The same talents can implement environmental management in an organization. Recruiting environmentalist people requires that organizations adopt environmental values (Ahmad and Nisar, 2015; Arulrajah, 2015; Prasad, 2013).

Green selection: to select manpower, organizations choose the volunteers that are interested in environmental issues (Cherian and Jacob, 2012; Road and Kingdom, 2013). While performing interview with the volunteers, they are required to answer the questions related to the environment (Bangwal and Tiwari, 2015). Perform such tasks is a good step for selecting candidates. In contrast, there are organizations that use common criteria for the selection of personnel (Arulrajah, 2015; Han et al., 2013).

Implementation of green policy: implementation of green policy for the employees who seem to require environment training is essential. For this goal, organizations can use two approaches: general green policy implementation for all employees and implementing specialized green policy for people who have special expertise. After the volunteers were selected, some organizations provide the employees with essential basic information about environmental management. Some others implement green policy effectively. They justify employees regarding their environmental socialized tasks. Organizations should be ensured that new employees have understood environmental issues and culture, learnt green management procedures, and are familiarized with employee security (Arulrajah, 2015).

Green Performance Evaluation: employee performance measurement is one of the key factors of green human resource management (Mandip, 2012; Prasad, 2013; Road and Kingdom, 2013). Without this manner, no organization can be ensured to have a substantial environmental performance. Employees' green performance measurement criteria must be exactly in line with the environmental criteria adopted by an organization (Ahmad and Nisar,

2015; Arulrajah, 2015; Han et al., 2013). In order to have a good environmental performance, organizations must establish green management information systems (Arulrajah, 2015; Jackson et al., 2011; Mandip, 2012; Road and Kingdom, 2013).

The systems seek to monitor pollution, energy consumption, and organization resource (Jackson et al., 2011). To evaluate green performance, environmental standards should be used (Mandip, 2012; Road and Kingdom, 2013). Of course, the use of these standards is not enough. The relationship between green plans, performance measures for all employees through performance evaluation systems and discussion about green issues re also needed to achieve green performance evaluation (Arulrajah, 2015; Mandip, 2012).

Green training: hold environmental education for organizational members is one of the important factors of Green Human Resource Management (Arulrajah, 2015; Road and Kingdom, 2013). This type of training seeks to increase the level of knowledge, skills and abilities of employees (Han et al., 2013; Prasad, 2013). This action significantly contributes to the implementation of environmental management programs (Arulrajah, 2015; Cherian and Jacob, 2012). Providing training to encourage employee to recycle and manage the waste materials (Arulrajah, 2015), support flexible and remote programs, and reduce business trips can significantly contribute to a reduction in the negative environmental impacts of the organization. Create environmental awareness among employees (Cherian and Jacob, 2012) by organizing seminars and workshops across the organization to achieve good environmental performance is important (Han et al., 2013; Road and Kingdom, 2013). Today, organizations analyze employees to identify individual training needs and to foster environmentalist employee (Arulrajah, 2015).

Green encouragement system management: environmental performance sustainability among organizations depends heavily on reward management practices (Arulrajah, 2015; Cherian and Jacob, 2012). Green reward management system plays a major role in motivating

managers and employees (Cherian and Jacob, 2012; Prasad, 2013) and create a change in their behavior. Organizations can implement the system in two ways: financial and non-financial rewards (Arulrajah, 2015; Jackson et al., 2011). In addition, the relationship between environmental benefit of employees is another kind of good work among organizations. Utilizing some approaches in the organizations, employees can create a link between their environmental benefits with the organizations. For example, managers can offer reward to the employee who provide the organization with a successful environmental program (Jackson et al., 2011; Mandip, 2012). Having employees' environmental performance recognition programs for organizations is demanding to be able to offer reward to people who have green performance (Ahmad and Nisar, 2015; Han et al., 2013).

Green health and employee safety management: Green Health and Safety Management is really beyond the scope of safety management function and traditional health of human resource management. This type of health management includes traditional health and also more aspects of environmental management organization. As a result, today, many organizations replace health and safety management with environmental management of health and safety. Environmental health and safety management is more widespread than its traditional types (Arulrajah, 2015). One of the factors that lead to health and safety environmental management is green working environment (Ahmad and Nisar, 2015). Green working environment is a place where there are environmental sensitivity, economic efficiency, and social responsibility (Ahmad and Nisar, 2015; Arulrajah, 2015).

Employee Discipline Green Management: this type of management is a precondition in environmental management of large-scale companies. To guarantee employee green behavior in the workplace, organization may recourse to green discipline management to accomplish such type of management to be able to accomplish environmental objectives and strategies and to have control over environmental performance (Bangwal and Tiwari, 2015; Wright and

McMahon, 2011). Some organizations have found that green discipline management acts as an instrument and can enable employees to adapt themselves to environment protection measures. These companies formulate a clear set of rules and regulations to guide employees in line with environmental policies in an organization (Bangwal and Tiwari, 2015; Jackson et al., 2011). In these organizations, if an employee violates the rules, he encounters some disciplinary measures such as warnings, fines, suspension, etc (Arulrajah, 2015; Bangwal and Tiwari, 2015).

Employee green relations: evolution of green human resource management influence employee relations and the activities relevant to practices of union management in an organization. Employee relations and support provided by a union (Road and Kingdom, 2013) plays a vital role in implementing the programs and actions of environmental management in organizations (Ahmad and Nisar, 2015; Bangwal and Tiwari, 2015; Cherian and Jacob, 2012). To gain the support of unions in relation to environmental management measures, some companies adopt a series of strategies. Some of these strategies include participatory consultation, increased sharing, and recognition of the union as a key stakeholder in environmental management (Arulrajah, 2015).

2.3.3. Economic Sustainability

Economic stability is achieved by saving valuable resources necessary for future generations (i.e. implementation of the principle of fair and equal distribution between generations). This approach is very evident in the literature of sustainable development, and in fact, it is based on utility theory and economic efficiency, and can be applied in the optimal use of scarce resources (Munasinghe, 1993), and given that economic stability is relevant to a reduction in expenses, and economic management can be achieved by better management of resources and

process efficiency, the following factors can be considered for improving better management and the competitive advantage of human resources (Rosso, 2015).

Human Resource efficiency: this factor includes the total quality management, employee productivity, efficiency in the use of equipment, process standardization, employee involvement, increased motivation and skills of employees, standardization of services, educational programs to increase the efficiency and effectiveness of employee and performance assessment (Copus and Crabtree, 1996; Youndt et al, 1996).

Re-engineering: process model's redesigning of team-based organizations to achieve more coordination, standardization of processes, define and prioritize objectives, define the structure, and coordinate the processes (Love and Gunasekaran, 1997)

Cost reduction strategy: which includes increasing the turnover and to minimize damage (Hanegraaf and Biewinga, 1998; Youndt et al., 2015).

The senior management commitment to economic sustainability: to create financial value through increased revenue and reduced costs and to create jobs in order to strengthen the sustainability of human resources (Glaser and Diele, 2004; Tisdell, 1996).

The development of facilities: set up expense improvement system, capital budgeting, unit monitoring, and performance control as some of the factors relevant to development of facilities (Tisdell, 1996; Vincent, 1997).

Macroeconomic policies: policies affected by the economic regulations which are developed and implemented by the government, demands and expectations applied by the market, competitors' actions and activities as well as pressure exerted by non-governmental organizations (Copus and Crabtree, 1996; Epstein, 2009; Hanegraaf and Biewinga, 1998; Vincent, 1997).

Employment guarantee: a human resource development strategy that creates sources of income for people in the community (Basu et al., 2009; Glaser and Diele, 2004; Jha et al., 2013).

Using field study and library method, the main dimensions and key factors affecting the implementation of sustainable human resource management were identified and explained in the previous section. Table 1 summarizes these findings and presents respective references.

Table 1

Key dimensions and factors affecting the implementation of sustainable human resource management.

Dimension	Criteria	References
Social Sustainability	Social infrastructure	(Chan and Lee, 2008; Chiu, 2003; Daly, 1973; Dobson, 1999; Dyllick and Hockerts, 2002; Enyedi, 2002; Gladwin et al., 1995; Hinrichsen, 1987; Melorose et al., 2015; Omann and Spangenberg, 2002)
	The availability of career opportunities	
	Accessibility	
	Ability to fulfill the psychological needs	
	Social justice	
	Social sustainability design	
	Social sustainability	
Environmental sustainability	Corporate social responsibility	(Arulrajah, 2015; Bramley et al., 2009; Dempsey et al., 2011; Han et al., 2013; Hopwood et al., 2005; Littig and Griessler, 2005; Peneda Saraiva and Silva Serrasqueiro, 2007; Randolph, 2004; Teck Hui, 2008)
	Green job design	
	Green human resource planning	
	Green employment	
	Green selection	
	implementation of green policy	
	Green Performance Evaluation	
	Green training	
	Green encouragement system management	
	Green health and employee safety management	
Employee Discipline Green Management		
Economic Sustainability	Employee green relations	(Bangwal and Tiwari, 2015; Cherian and Jacob, 2012; Jackson et al., 2011; Mandip, 2012; Munasinghe, 1993; Road and Kingdom, 2013; Wright and McMahan, 2011)
	Human Resource efficiency	
	Re-engineering	
	Cost reduction strategy	
	The senior management commitment to economic sustainability	
	The development of facilities	
	Macroeconomic policies	
Employment guarantee		

3. The proposed approach

The research aimed to identify and rank the factors affecting the implementation of sustainable HR management. SMEs of Kerman, Iran were selected as case study. Literature, similar studies, and opinions of experts were employed to identify the factors. According to the identified factors, hierarchical tree is drawn. Fuzzy AHP and fuzzy DEMATEL Type II, used in the study by Abdullah and Zulkifli (2015), were employed to determine the cause-and-effect relationship of factors affecting the sustainable HR management implementation.

The intended integration method is basically hybridizing the two methods where the output from the first method is used as a multiplying factor to the computational steps of the second method. The integration of fuzzy AHP and Type-2 Fuzzy DEMATEL is constructed without losing the generality of the fuzzy AHP and fuzzy DEMATEL. Based on the objective and approach, the study consists of three phase.

3.1. First phase: Identifying factors affecting the sustainable HR management

In this section, a desk study was performed and opinions of experts were used to identify the factors affecting the sustainable HR management.

3.2. Second phase: determining the fuzzy weights using FAHP technique

AHP is a multi-criteria decision-making method to determine the weight and extent of preference of factors. AHP is a technique used for solving multi-criteria decision-making problems (Abdullah and Zulkifli, 2015; Satty, 1980). Factors affecting HR sustainability have hierarchical structure with three dimensions (economic, social, and environmental) with components for each dimension. Therefore, AHP is an appropriate technique to determine the weights of factors affecting HR sustainability.

Analytical Hierarchy Process (AHP) is a method of decision making in relation to decision-makers' objective to solve complex multiple criteria problems. In AHP, evaluation of

complicated problems is comprised of different layers, and the layers are also divided into different sub-layers. Decision makers must perform a pair-wise comparison between the factors, and assign a relative score to each factor in terms of the impact on the problem (Abdullah and Zulkifli, 2015; Satty, 1980). In a paper composed by Chang [1967], fuzzy hierarchical approach is discussed. As uncertainty is one of the most common decision making problems, fuzzy decision making approaches have been emerged for responding to this problem (Ting, 2016). This approach allows decision makers to express their priority and opinions by fuzzy numbers, and include uncertainty in the judgments in this cases. Fuzzy theory is a mathematical theory which is designed to understand obscure human behaviors, and decision-maker expresses his view in an optimistic, pessimistic, medium, totally relevant and many other forms (Zimmermann, 1996). In the current research, to determine the weight of effective criteria for implementing sustainable human resources management, hierarchical fuzzy methods are used. The steps to this technique are as follows:

Step 1. Draw a hierarchical graph

Hierarchical structure consists of two levels that the higher level is composed of dimensions, and lower level is composed of criteria and attributes.

Step 2. Construct a pair-wise comparison.

The pair-wise comparison is constructed among all criteria in the dimensions of the hierarchy system based on the DMs' preferences in using verbal statements in Table 1 as following matrix A,

$$A = \begin{bmatrix} 1 & \tilde{a}_{12} & \cdots & \tilde{a}_{1n} \\ \tilde{a}_{21} & 1 & \cdots & \tilde{a}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \cdots & 1 \end{bmatrix} = \begin{bmatrix} 1 & \tilde{a}_{12} & \cdots & \tilde{a}_{1n} \\ 1/\tilde{a}_{12} & 1 & \cdots & \tilde{a}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/\tilde{a}_{n1} & 1/\tilde{a}_{n2} & \cdots & 1 \end{bmatrix} \quad (1)$$

Step 3. Aggregate DMs' preferences.

The pair-wise comparisons matrices are aggregated using geometric mean suggested by(Buckley, 1984) as shown in Eq. (2).

$$\tilde{a}_{ij} = (\tilde{a}_{ij}^1 \otimes \tilde{a}_{ij}^2 \otimes \dots \otimes \tilde{a}_{ij}^n)^{\frac{1}{n}} \quad (2)$$

Where n is the number of DMs.

Step 4. Calculate the fuzzy weights.

The aggregated matrix comparison of each dimension and criterion is constructed using Eq. (3).

$$\tilde{a}_j = (\tilde{a}_{m1} \otimes \tilde{a}_{m2} \otimes \dots \otimes \tilde{a}_{mn})^{\frac{1}{n}} \quad (3)$$

Where $j = 1, 2, \dots, n$ and m = trapezoidal fuzzy number.

The fuzzy weight, W_j is determined using Eq. (4).

$$\tilde{w}_j = \tilde{a}_j \otimes (\tilde{a}_1 \oplus \tilde{a}_2 \oplus \dots \oplus \tilde{a}_n)^{-1} \quad \text{where } j = 1, 2, \dots, n \quad (4)$$

Step 5. Calculate the total fuzzy weights for attributes or criteria of dimensions.

Total fuzzy weights for attributes or criteria are obtained by multiplying the fuzzy weights of dimensions and fuzzy weights of attributes or criteria,

$$T\tilde{w}_j = D\tilde{w}_j \otimes C\tilde{w}_j \quad (5)$$

Where $D\tilde{w}_j$ are the weights of dimensions and $C\tilde{w}_j$ are the weights of attributes or criteria.

Step 6. Defuzzify and normalize the fuzzy weights.

Trapezoidal fuzzy weights are defuzzified and normalized using the centroid defuzzification method(Wang, 2009).

$$W_j = \frac{1}{3} \left[a + b + c + d - \frac{dc - ab}{(d + c) - (a + b)} \right] \quad (6)$$

3.3. Third phase: the relationship between the indexes using Type-2 fuzzy DEMATEL technique

DEMATEL method was first developed by two researchers named Fontela and Gabos in 1976. This technique is one decision making method based on pairwise comparisons. The technique was first used in Geneva Research Centre for solving critical problems such as famine, energy, environmental preservation, etc (Trevithick et al, 2003). This method is a decision-making tool built upon graph theory, and helps to plan and solve problems, and to outline several criteria in the form of cause and effect for the better understanding of network relations map (Gabus and Fontela, 1972). In other words, by examining the interaction between standards, the technique specifies their importance and effectiveness in the form of numerical rating. The most important characteristic of multi-criteria decision-making method is to create relationships between agents and structure. In addition to the conversion of the causal relationships into a visual structural model, this technique is able to identify internal dependencies between elements and to make them more understandable (Gabus and Fontela, 1972). However, in general, the estimation of experts' opinions using exact numerical values, especially in terms of uncertainty, is highly challenging. This is because decision making results are severely dependent upon inaccurate and ambiguous subjective judgments. This factor has led to the need to fuzzy logic DEMATEL. As a result, in DEMATEL, type-2 fuzzy linguistic variables are used, and this can facilitate decision-making under environmental uncertainty conditions (Abdullah and Zulkifli, 2015).

Step 7. Generating the initial direct-relation matrix.

The IT2 FN score x_{ij}^k is given by the k th decision-maker and indicated the influential level that criteria i has on criteria j . The $m \times n$ matrix is calculated using Eq. (7) by averaging the individual decision-makers' scores in Table 5.

$$A_{ij} = \frac{1}{H} \sum_{k=1}^H x_{ij}^k \quad (7)$$

where H is the total number of DMs and $x_{ij}^k = ((a, b, c, d, e, f), (g, h, i, j, k, l))$ where a, b, c and d are UMF, g, h, i and j are LMF while e, f, k and l are the height of UMF and LMF. Matrix A_{ij} shows the initial direct-relation that a criterion exerts on and received from other criteria.

Step 8. Calculating the normalized initial direct-relation matrix, D.

On the base of the initial direct-relation matrix, A_{ij} , the normalized initial direct-relation matrix, D can be obtained through the following equations.

$$D = \frac{A}{S} \quad (8)$$

$$S = \max \left(\max_{1 \leq i \leq n} \sum_{j=1}^n A_{ij}, \max_{1 \leq i \leq n} \sum_{i=1}^n A_{ij} \right) \quad (9)$$

Where $\max_{1 \leq j \leq n} \sum_{j=1}^n A_{ij}$ = the total direct effects of the criterion i with the most direct effects on others, and $\max_{1 \leq j \leq n} \sum_{i=1}^n A_{ij}$ = the total direct effects that the criterion j receives the most direct effects from other criteria.

In other words, Eq. (9) is utilized to find the sum of each row of matrix A represented the total direct effects the criterion i gave to the other criteria and the sum of each column of matrix A represented the total direct effects received to other criteria by criterion i.

Step 9. Construct the $n \times n$ matrix, Z.

Matrix Z is constructed by arranging matrix N according to the membership functions.

$$Z_x = \begin{bmatrix} 0 & x_{12} & \cdots & x_{1n} \\ x_{21} & 0 & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & 0 \end{bmatrix} \quad (10)$$

Where $x = (UMF, LMF) = ((a, b, c, d), (g, h, i, j))$. As a result, there are eight $n \times n$ matrices. Construction of $n \times n$ matrix is needed for the calculation in the next step since it involves multiplication of matrices between matrix Z and identity matrix. The row of matrix Z must be matched with column of identity matrix.

Step 10. Attaining the total-influence matrix, T.

The total-influence matrix, T can be acquired using Eq. (11) in which I is denoted as the identity matrix.

$$T_x = Z_x (I - Z_x)^{-1} \quad (11)$$

Step 11. Structural correlation analysis.

The sum of rows and the sum of columns were separately denoted as vector r and c through Eq. (12) – (14). $D_i + R_i$ is made by adding r to c and $D_i - R_i$ is made by subtracting r from c.

$$T_x = [t_{ij}]_{n \times n} \quad i, j = 1, 2, \dots, n \quad (12)$$

$$r_x = \left[\sum_{j=1}^n t_{ij} \right]_{n \times 1 = [t_i]_{n \times 1}} \quad (13)$$

$$c_x = \left[\sum_{j=1}^n t_{ij} \right]_{1 \times n = [t_i]_{1 \times n}} \quad (14)$$

Where $x = (UMF, LMF) = ((a, b, c, d), (g, h, i, j))$

Step 12. Calculate expected value, $E(W)$.

The expected values of $E(D_i - R_i)$ and $E(D_i + R_i)$ are calculated using equation Eq. (15).

$$E(W) = \frac{1}{2} \left(\frac{1}{4} \sum_{i=1}^4 (w_i^l + w_i^u) \right) \times \frac{1}{4} \left(\sum_{i=1}^2 (w_i (A^l) + w_i (A^u)) \right) \quad (15)$$

Where

$$w_i = (w_i^u + w_i^l) = \left(\begin{array}{l} (w_1^U, w_2^U, w_3^U, w_4^U; H_1(w_i^U), H_2(w_i^U)), \\ (w_1^L, w_2^L, w_3^L, w_4^L; H_1(w_i^L), H_2(w_i^L)) \end{array} \right) \quad (16)$$

Step 13. Combining fuzzy weights and $E(W)$.

Fuzzy weights from Step 6 in phase 2 are combined with $E(W)$. The new expected value is obtained using the multiplication operation as Eq. (16)

$$E(W)_{new} = w_j \otimes E(W) \quad (17)$$

Step 14. Construct causal diagram.

The horizontal axis vector, $D_i + R_i$ named ‘‘Prominence’’ shows the degree of importance that criterion i plays in the system. The vertical axis $D_i - R_i$; named ‘‘Relation’’ shows the net effect the criterion i contributed to the system. When $D_i - R_i$ is positive, criterion i is a net causer and when $D_i - R_i$ is negative, criterion i is a net receiver (Abdullah and Zulkifli, 2015).

The framework is summarized in Fig. 1.

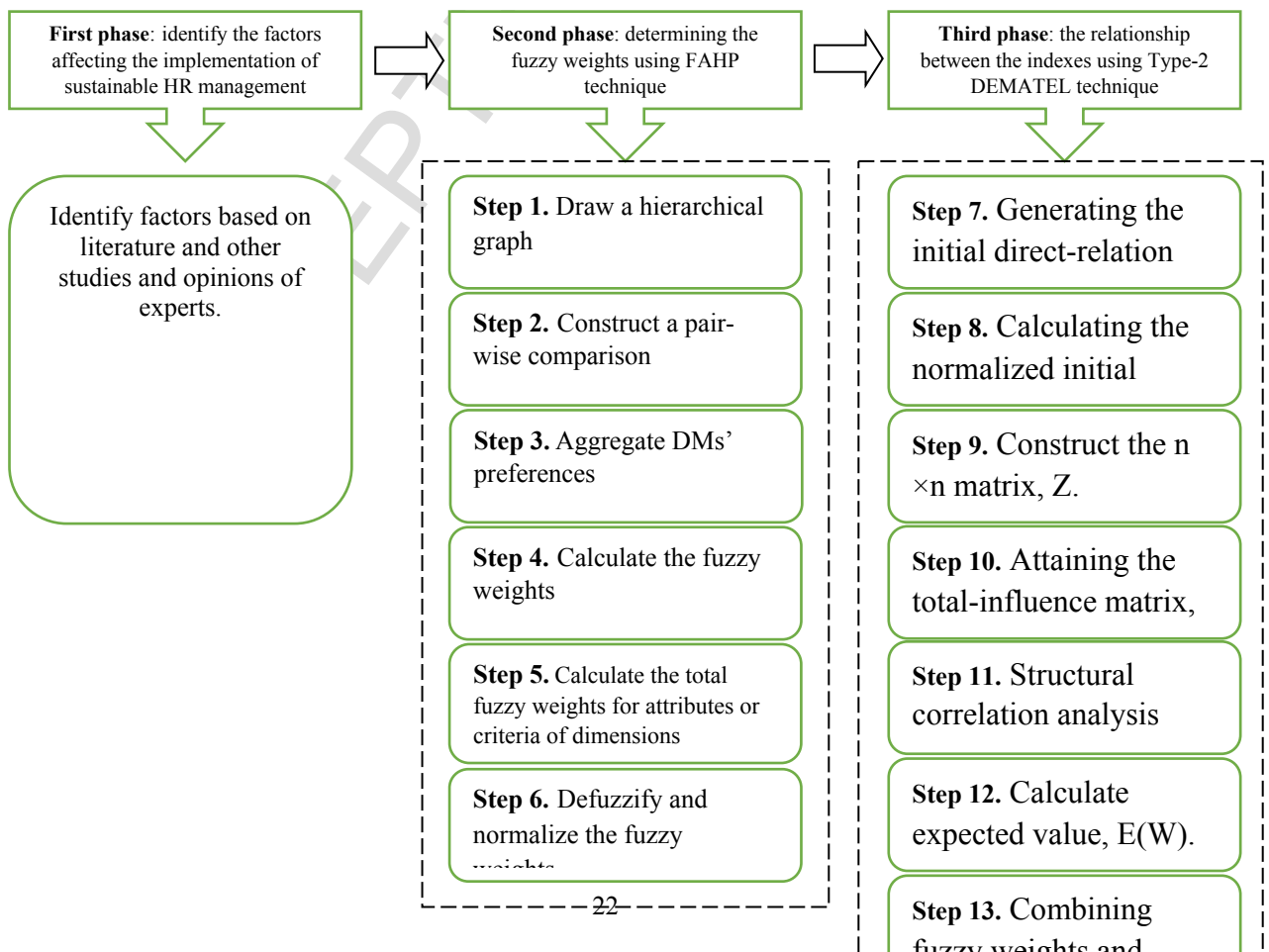


Fig 1. The research process

4. Research Results

In the present study, the results obtained from data collection are offered in three phases.

First phase. Identifying factors affecting the sustainable HR management.

The literature was reviewed and opinions of experts were employed to identify the factors. As stated earlier, SMEs of Kerman, Iran were selected for the study. Therefore, the experts were the managers of HR units in these industries. A sample of 10 experts who were familiar with sustainability and green management principles were selected for the study. In order to modify the factors, interviews were conducted with the experts. Factors were reviewed during the interviews. Some were removed and some were added. Accordingly, 26 criteria were taken into account in three dimensions.

Second phase. determining the weights of fuzzy technique using FAHP

The results of this phase of the research are presented in the following steps.

Step 1. draw hierarchical tree. According to the identified factors in the first phase, the hierarchical tree was drawn as shown in Fig. 2.

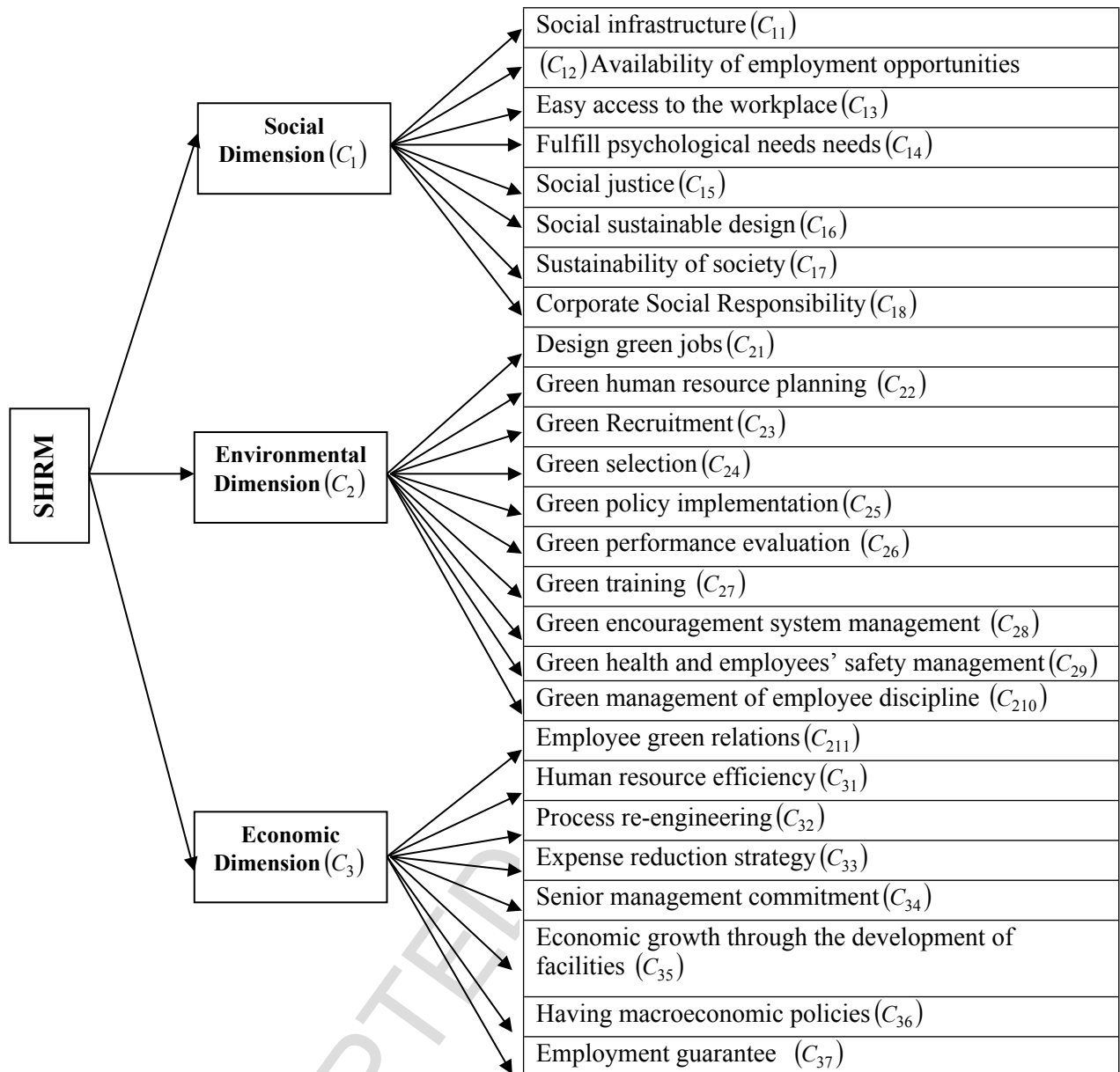


Fig 2. The hierarchical tree of the factors influencing the implementation of sustainable human resource management

Step 2. form a matrix of paired comparisons using fuzzy numbers: based on the research's hierarchical tree, the pairwise comparisons questionnaire was designed, and then distributed between the experts practicing in small and medium industry in Kerman province. After collecting Linguistic variables, and using Table 2, the Linguistic variables turned into fuzzy numbers.

Table 2

Trapezoidal fuzzy number preference scale (Zheng et al., 2012).

Linguistic variables	Scale of relative important of AHP crisp number	Trapezoidal fuzzy number	Reciprocal trapezoidal fuzzy number
Equally important (EI)	1	(1, 1, 1, 1)	(1, 1, 1, 1)
Intermediate value (IV)	2	(1, 3/2, 5/2, 3)	(1/3, 2/5, 2/3, 1)
Moderately more important (MMI)	3	(2, 5/2, 7/2, 4)	(1/4, 2/9, 2/5, 1/2)
Intermediate value (IV)	4	(3, 7/2, 9/2, 5)	(1/5, 2/9, 2/7, 1/3)
Strongly more important (SMI)	5	(4, 9/2, 11/2, 6)	(1/6, 2/11, 2/9, 1/4)
Intermediate value (IV)	6	(5, 11/2, 13/2, 7)	(1/7, 2/13, 2/11, 1/5)
Very strong more important (VSMI)	7	(6, 13/2, 15/2, 8)	(1/8, 2/15, 2/13, 1/6)
Intermediate value (IV)	8	(7, 15/2, 17/2, 9)	(1/9, 2/17, 2/15, 1/7)
Extremely more important (EMI)	9	(8, 17/2, 9, 9)	(1/9, 1/9, 2/17, 1/8)

Step 3. Aggregate matrix of the experts' paired comparisons: experts' pairwise comparison matrix is aggregated using equation (2). Table 3 presents the matrix sample of paired comparisons related to the aspects of the sustainable human resources.

Table 3

The matrix of pair-wise comparisons related to the dimensions of sustainable human resources management

SHRM	C_1	C_2	C_3
C_1	(1,1,1,1)	(1.68,1.91,2.38,2.63)	(0.58,0.62,0.72,0.78)
C_2	(0.38,0.42,0.52,0.59)	(1,1,1,1)	(0.56,0.61,0.76,0.85)
C_3	(1.28,1.39,1.62,1.73)	(1.17,1.32,1.63,1.8)	(1,1,1,1)

Step 4. Calculate fuzzy weights: after determining the pairwise comparison matrices, using equations (3) and (4), the fuzzy weights of each dimension was determined in Table 4. The relevant practice was repeated for the indices of each dimension.

Table 4

The geometrical-fuzzy mean of the factors affecting the implementation of sustainable human resources

SHRM	Fuzzy geometric mean	Fuzzy weight	Weight De Fuzzy
C_1	(0.99,1.06,1.2,1.27)	(0.281,0.319,0.409,0.466)	0.3693
C_2	(0.6,0.64,0.73,0.79)	(0.169,0.192,0.252,0.292)	0.2267
C_3	(1.14,1.22,1.38,1.46)	(0.324,0.37,0.473,0.535)	0.4260
$\tilde{a}_1 \oplus \tilde{a}_2 \oplus \dots \oplus \tilde{a}_n$	(2.73,2.92,3.31,3.52)		
$(\tilde{a}_1 \oplus \tilde{a}_2 \oplus \dots \oplus \tilde{a}_n)^{-1}$	(0.28,0.3,0.34,0.37)		

The results of table 3, indicated that C3 had more weight than the other two dimensions. That is to say, C3 was the most important dimension followed by C1 and C2.

Step 5. Calculate the total weight of indices: based on the equation (5), the normalized weight of the criteria affecting the implementation of sustainable human resource management was determined based on Table 5.

Table 5

Normalized weight of the criteria

SHRM	criteria	$C\tilde{w}_j$	$T\tilde{w}_j$	W_j
C_1	c_{11}	(0.08, 0.10, 0.13, 0.15)	(0.02, 0.03, 0.05, 0.07)	0.0438
	c_{12}	(0.07, 0.08, 0.11, 0.13)	(0.02, 0.03, 0.05, 0.06)	0.0384
	c_{13}	(0.05, 0.06, 0.08, 0.09)	(0.01, 0.02, 0.03, 0.04)	0.0275
	c_{14}	(0.07, 0.09, 0.11, 0.13)	(0.02, 0.03, 0.05, 0.06)	0.0395
	c_{15}	(0.15, 0.18, 0.24, 0.28)	(0.04, 0.06, 0.10, 0.13)	0.0830
	c_{16}	(0.10, 0.11, 0.15, 0.18)	(0.03, 0.04, 0.06, 0.08)	0.0525
	c_{17}	(0.13, 0.15, 0.20, 0.23)	(0.04, 0.05, 0.08, 0.11)	0.0687
	c_{18}	(0.08, 0.10, 0.13, 0.15)	(0.02, 0.03, 0.05, 0.07)	0.0456
C_2	c_{21}	(0.05, 0.06, 0.08, 0.09)	(0.01, 0.01, 0.02, 0.03)	0.0169
	c_{22}	(0.07, 0.08, 0.11, 0.13)	(0.01, 0.02, 0.03, 0.04)	0.0232
	c_{23}	(0.07, 0.08, 0.11, 0.13)	(0.01, 0.02, 0.03, 0.04)	0.0233
	c_{24}	(0.05, 0.07, 0.07, 0.07)	(0.01, 0.01, 0.02, 0.02)	0.0157
	c_{25}	(0.05, 0.06, 0.09, 0.10)	(0.01, 0.01, 0.02, 0.03)	0.0184
	c_{26}	(0.04, 0.05, 0.06, 0.08)	(0.01, 0.01, 0.02, 0.02)	0.0134
	c_{27}	(0.08, 0.09, 0.13, 0.16)	(0.01, 0.02, 0.03, 0.05)	0.0283
	c_{28}	(0.08, 0.10, 0.14, 0.16)	(0.01, 0.02, 0.03, 0.05)	0.0288

C_3	c_{29}	(0.09, 0.11, 0.15, 0.17)	(0.02, 0.02, 0.04, 0.05)	0.0311
	c_{210}	(0.07, 0.09, 0.12, 0.14)	(0.01, 0.02, 0.03, 0.04)	0.0255
	c_{211}	(0.07, 0.08, 0.10, 0.12)	(0.01, 0.01, 0.03, 0.03)	0.0217
	c_{31}	(0.08, 0.10, 0.13, 0.15)	(0.03, 0.04, 0.06, 0.08)	0.0509
	c_{32}	(0.07, 0.08, 0.11, 0.13)	(0.02, 0.03, 0.05, 0.07)	0.0449
	c_{33}	(0.07, 0.09, 0.12, 0.15)	(0.02, 0.03, 0.06, 0.08)	0.0487
	c_{34}	(0.12, 0.14, 0.19, 0.22)	(0.04, 0.05, 0.09, 0.12)	0.0738
	c_{35}	(0.13, 0.16, 0.21, 0.25)	(0.04, 0.06, 0.10, 0.13)	0.0844
	c_{36}	(0.14, 0.17, 0.23, 0.26)	(0.05, 0.06, 0.11, 0.14)	0.0899
	c_{37}	(0.11, 0.13, 0.18, 0.20)	(0.04, 0.05, 0.08, 0.11)	0.0698

The results of table 5, showed that "macroeconomic policies" were the most important; however, "Green Performance Evaluation" was the least important among the 26 identified factors.

Step 6. Defuzzification and normalization the fuzzy weights: using equation (6), the Defuzzied values of the weights affecting the implementation of sustainable human resource management were determined (Table 5).

Third phase. *the relationship between the indices using Type-2 fuzzy DEMATEL technique*

Step 7. Create an initial matrix of direct relationships (A): After the definitive weights of the indices were obtained, the questionnaire relevant to the level of influence of each indicator to other indicators was prepared, and distributed among the experts, and after gathering expert opinions and using Table 6, the verbal data were converted into type-2 trapezoidal fuzzy numbers, and then the basic matrix of the direct relationship was determined using equation (7). For example, in Table 7, the primary matrix of the direct relationships related to the dimensions is presented.

Table 6

Linguistic variables (Abdullah and Najib, 2014)

Linguistic variables	IT2 FN
Very high influence	((0.8, 0.9, 0.9, 1.0; 1, 1), (0.85, 0.9, 0.9, 0.95; 0.9, 0.9))
High influence	((0.6, 0.7, 0.7, 0.8; 1, 1), (0.65, 0.7, 0.7, 0.75; 0.9, 0.9))
Low influence	((0.4, 0.5, 0.5, 0.6; 1, 1), (0.45, 0.5, 0.5, 0.55; 0.9, 0.9))
Very low influence	((0.2, 0.3, 0.3, 0.4; 1, 1), (0.25, 0.3, 0.3, 0.35; 0.9, 0.9))
No influence	((0, 0.1, 0.1, 0.1; 1, 1), (0, 0.1, 0.1, 0.05; 0.9, 0.9))

Table 7

The primary matrix of the direct relationships relevant to the dimensions affecting human resources for sustainable success

SHRM	C_1	C_2	C_3
C_1	((0,0.1,0.1,0.1;1,1),(0,0.1,0.1,0.05;0.9,0.9))	((0.2,0.3,0.3,0.37;1,1),(0.23,0.3,0.3,0.32;0.9,0.9))	((0.4,0.5,0.5,0.6;1,1),(0.45,0.5,0.5,0.55;0.9,0.9))
C_2	((0.6,0.7,0.7,0.8;1,1),(0.65,0.7,0.7,0.75;0.9,0.9))	((0,0.1,0.1,0.1;1,1),(0,0.1,0.1,0.05;0.9,0.9))	((0.4,0.5,0.5,0.6;1,1),(0.45,0.5,0.5,0.55;0.9,0.9))
C_3	((0.33,0.43,0.43,0.53;1,1),(0.38,0.43,0.43,0.48;0.9,0.9))	((0.27,0.37,0.37,0.43;1,1),(0.3,0.37,0.37,0.38;0.9,0.9))	((0,0.1,0.1,0.1;1,1),(0,0.1,0.1,0.05;0.9,0.9))

Step 8. normalize the initial matrix of direct relationships (D): the normalized matrix of direct relationship was obtained using the equations. (8) and (9). Table 8, shows this matrix for the dimensions that affect the success of sustainable human resources.

Table 8

Initial normalized matrix of the direct relationships of the dimensions affecting the success of sustainable human resources.

SHRM	C_1	C_2	C_3
C_1	((0,0.067,0.067,0.067;1,1),(0,0.067,0.067,0.033;0.9,0.9))	((0.133,0.2,0.2,0.244;1,1),(0.156,0.2,0.2,0.211;0.9,0.9))	((0.267,0.333,0.333,0.4;1,1),(0.3,0.333,0.333,0.367;0.9,0.9))
C_2	((0.4,0.467,0.467,0.533;1,1),(0.433,0.467,0.467,0.5;0.9,0.9))	((0,0.067,0.067,0.067;1,1),(0,0.067,0.067,0.033;0.9,0.9))	((0.267,0.333,0.333,0.4;1,1),(0.3,0.333,0.333,0.367;0.9,0.9))
C_3	((0.222,0.289,0.289,0.356;1,1),(0.256,0.289,0.289,0.322;0.9,0.9))	((0.178,0.244,0.244,0.289;1,1),(0.2,0.244,0.244,0.256;0.9,0.9))	((0,0.067,0.067,0.067;1,1),(0,0.067,0.067,0.033;0.9,0.9))

Step 9. Construct the $n \times n$ matrix, Z_x .

Matrix Z_x are arranged from matrix D according to the membership functions using Eq. (10).

There are eight $n \times n$ matrices; $Z_a, Z_b, Z_c, Z_d, Z_g, Z_h, Z_i$ and Z_j . As an example, the matrix of Z_a is given as

$$Z_a = \begin{bmatrix} 0 & 0.133 & 0.267 \\ 0.4 & 0 & 0.267 \\ 0.222 & 0.178 & 0 \end{bmatrix}$$

Step 10. Explain the total relationship matrix (T_x): The matrix of total relationships was obtained using equation (11), respectively. Matrix of total relationships for successful implementation of sustainable human resource management is shown in Table 9. Based on the above relationship, the total relationship matrix of the indices was determined in the form of a 26×26 matrix.

Table 9

Matrix of total relationships affecting the success of sustainable human resources

SHRM	C_1	C_2	C_3
C_1	((0.172,0.571,0.571,1.132;1,1), (0.24,0.571,0.571,0.602;0.9,0.9))	((0.222,0.533,0.533,0.97;1,1),(0.284,0.533,0.533,0.568;0.9,0.9))	((0.372,0.751,0.751,1.329;1,1),(0.457,0.751,0.751,0.823;0.9,0.9))
C_2	((0.565,1.058,1.058,1.806;1,1), (0.673,1.058,1.058,1.146;0.9,0.9))	((0.157,0.541,0.541,1.057;1,1),(0.218,0.541,0.541,0.556;0.9,0.9))	((0.459,0.928,0.928,1.656;1,1),(0.567,0.928,0.928,1.025;0.9,0.9))
C_3	((0.361,0.763,0.763,1.371;1,1), (0.451,0.763,0.763,0.837;0.9,0.9))	((0.255,0.569,0.569,1.006;1,1),(0.316,0.569,0.569,0.6;0.9,0.9))	((0.164,0.547,0.547,1.09;1,1),(0.23,0.547,0.547,0.58;0.9,0.9))

Step 11. Analyze the causal relationships: Total amount of rows and columns in order to obtain an analysis of the causal relationships was calculated. Equations (12-14) for determining the values of $(\tilde{D}_i + \tilde{R}_i)$ and $(\tilde{D}_i - \tilde{R}_i)$ were used. The results related to the dimensions and metrics are presented in Tables 10 and 11.

Table 10

 $(\tilde{D}_i + \tilde{R}_i)$ and $(\tilde{D}_i - \tilde{R}_i)$ Dimension Implementation of SHRM

SHRM	$(\tilde{D}_i + \tilde{R}_i)$	$(\tilde{D}_i - \tilde{R}_i)$	D+R	D-R
C_1	((1.86,4.25,4.25,7.74;1,1),(2.35,4.25,4.25,4.58;0.9,0.9))	((-0.33,-0.54,-0.54,-0.88;1,1),(-0.38,-0.54,-0.54,-0.59;0.9,0.9))	4.08	-0.53
C_2	((1.82,4.17,4.17,7.55;1,1),(2.28,4.17,4.17,4.45;0.9,0.9))	((0.55,0.88,0.88,1.49;1,1),(0.64,0.88,0.88,1;0.9,0.9))	3.99	0.88
C_3	((1.78,4.11,4.11,7.54;1,1),(2.25,4.11,4.11,4.45;0.9,0.9))	((-0.21,-0.35,-0.35,-0.61;1,1),(-0.26,-0.35,-0.35,-0.41;0.9,0.9))	3.95	-0.35

Table 11

 $(\tilde{D}_i + \tilde{R}_i)$ and $(\tilde{D}_i - \tilde{R}_i)$ criteria of implementation of SHRM

SHRM	criteria	$(\tilde{D}_i + \tilde{R}_i)$	$(\tilde{D}_i - \tilde{R}_i)$	D+R	D-R
C_1	C_{11}	((1.54,2.8,2.8,4.46;1,1),(1.92,2.8,2.8,3.22;0.9,0.9))	((0.93,1.26,1.26,1.82;1,1),(1.07,1.26,1.26,1.47;0.9,0.9))	2.72	1.26
	C_{12}	((1.21,2.35,2.35,3.82;1,1),(1.54,2.35,2.35,2.7;0.9,0.9))	((0.17,0.23,0.23,0.34;1,1),(0.2,0.23,0.23,0.28;0.9,0.9))	2.27	0.23
	C_{13}	((0.88,1.9,1.9,3.06;1,1),(1.12,1.9,1.9,2.08;0.9,0.9))	((0.1,0.13,0.13,0.15;1,1),(0.1,0.13,0.13,0.12;0.9,0.9))	1.79	0.12
	C_{14}	((1.82,3.17,3.17,5.04;1,1),(2.24,3.17,3.17,3.68;0.9,0.9))	((-0.24,-0.33,-0.33,-0.49;1,1),(-0.28,-0.33,-0.33,-0.4;0.9,0.9))	3.10	-0.33
	C_{15}	((1.75,3.07,3.07,4.83;1,1),(2.14,3.07,3.07,3.52;0.9,0.9))	((-0.13,-0.18,-0.18,-0.31;1,1),(-0.17,-0.18,-0.18,-0.25;0.9,0.9))	2.99	-0.19
	C_{16}	((1.87,3.24,3.24,5.19;1,1),(2.32,3.24,3.24,3.8;0.9,0.9))	((-0.08,-0.11,-0.11,-0.15;1,1),(-0.09,-0.11,-0.11,-0.12;0.9,0.9))	3.19	-0.11
	C_{17}	((1.82,3.17,3.17,5.07;1,1),(2.25,3.17,3.17,3.71;0.9,0.9))	((-0.15,-0.2,-0.2,-0.24;1,1),(-0.15,-0.2,-0.2,-0.19;0.9,0.9))	3.11	-0.19
	C_{18}	((1.49,2.72,2.72,4.4;1,1),(1.86,2.72,2.72,3.16;0.9,0.9))	((-0.6,-0.81,-0.81,-1.13;1,1),(-0.67,-0.81,-0.81,-0.91;0.9,0.9))	2.66	-0.80
C_2	C_{21}	((1.21,1.98,1.98,2.89;1,1),(1.46,1.98,1.98,2.25;0.9,0.9))	((0.51,0.63,0.63,0.87;1,1),(0.58,0.63,0.63,0.76;0.9,0.9))	1.92	0.64
	C_{22}	((1.2,1.98,1.98,2.9;1,1),(1.46,1.98,1.98,2.26;0.9,0.9))	((0.34,0.43,0.43,0.53;1,1),(0.37,0.43,0.43,0.46;0.9,0.9))	1.92	0.41
	C_{23}	((0.98,1.7,1.7,2.53;1,1),(1.21,1.7,1.7,1.94;0.9,0.9))	((0.24,0.3,0.3,0.44;1,1),(0.28,0.3,0.3,0.38;0.9,0.9))	1.64	0.31
	C_{24}	((1.06,1.8,1.8,2.67;1,1),(1.31,1.8,1.8,2.06;0.9,0.9))	((0.06,0.07,0.07,0.12;1,1),(0.07,0.07,0.07,0.1;0.9,0.9))	1.74	0.08
	C_{25}	((1.73,2.63,2.63,3.77;1,1),(2.05,2.63,2.63,3.02;0.9,0.9))	((-0.64,-0.8,-0.8,-0.99;1,1),(-0.7,-0.8,-0.8,-0.86;0.9,0.9))	2.57	-0.78
	C_{26}	((1.23,2.01,2.01,2.98;1,1),(1.51,2.01,2.01,2.33;0.9,0.9))	((-0.01,-0.01,-0.01,-0.04;1,1),(-0.02,-0.01,-0.01,-0.04;0.9,0.9))	1.96	-0.02
	C_{27}	((1.11,1.86,1.86,2.75;1,1),(1.36,1.86,1.86,2.13;0.9,0.9))	((-0.04,-0.04,-0.04,-0.08;1,1),(-0.05,-0.04,-0.04,-0.07;0.9,0.9))	1.80	-0.05
	C_{28}	((1.08,1.82,1.82,2.72;1,1),(1.33,1.82,1.82,2.11;0.9,0.9))	((-0.1,-0.13,-0.13,-0.21;1,1),(-0.13,-0.13,-0.13,-0.18;0.9,0.9))	1.77	-0.14
C_3	C_{29}	((1.1,1.85,1.85,2.8;1,1),(1.37,1.85,1.85,2.17;0.9,0.9))	((-0.1,-0.12,-0.12,-0.17;1,1),(-0.11,-0.12,-0.12,-0.15;0.9,0.9))	1.81	-0.12
	C_{210}	((1.15,1.91,1.91,2.88;1,1),(1.43,1.91,1.91,2.25;0.9,0.9))	((-0.05,-0.06,-0.06,-0.08;1,1),(-0.05,-0.06,-0.06,-0.07;0.9,0.9))	1.87	-0.06
	C_{211}	((1.34,2.15,2.15,3.15;1,1),(1.63,2.15,2.15,2.48;0.9,0.9))	((-0.22,-0.27,-0.27,-0.38;1,1),(-0.25,-0.27,-0.27,-0.33;0.9,0.9))	2.10	-0.28
	C_{31}	((1.93,3.44,3.44,5.89;1,1),(2.42,3.44,3.44,4.16;0.9,0.9))	((-0.34,-0.47,-0.47,-0.75;1,1),(-0.4,-0.47,-0.47,-0.59;0.9,0.9))	3.44	-0.49
	C_{32}	((2.04,3.59,3.59,6.17;1,1),(2.56,3.59,3.59,4.38;0.9,0.9))	((0,0,0,0.01;1,1),(0,0,0,0.01;0.9,0.9))	3.60	0.00
C_{33}	((2.01,3.56,3.56,6.13;1,1),(2.54,3.56,3.56,4.35;0.9,0.9))	((0.03,0.04,0.04,0.07;1,1),(0.04,0.04,0.04,0.05;0.9,0.9))	3.57	0.04	

C_{34}	((2.04,3.6,3.6,6.14;1,1),(2.56,3.6,3.6,4.36;0.9,0.9))	((0.73,1.02,1.02,1.51;1,1),(0.84,1.02,1.02,1.18;0.9,0.9))	3.60	1.01
C_{35}	((1.92,3.43,3.43,5.89;1,1),(2.42,3.43,3.43,4.17;0.9,0.9))	((-0.23,-0.32,-0.32,-0.4;1,1),(-0.24,-0.32,-0.32,-0.31;0.9,0.9))	3.43	-0.30
C_{36}	((1.89,3.38,3.38,5.82;1,1),(2.38,3.38,3.38,4.11;0.9,0.9))	((-0.04,-0.05,-0.05,-0.02;1,1),(-0.03,-0.05,-0.05,-0.02;0.9,0.9))	3.38	-0.04
C_{37}	((1.38,2.68,2.68,4.79;1,1),(1.8,2.68,2.68,3.31;0.9,0.9))	((-0.16,-0.22,-0.22,-0.4;1,1),(-0.2,-0.22,-0.22,-0.31;0.9,0.9))	2.68	-0.24

Step 12. Calculate expected value, $E(W)$.

Expected values convert the IT2 trapezoidal fuzzy numbers of $D_i + R_i$ and $D_i - R_i$ into crisp values using Eq. (15). The crisp values of $D_i + R_i$ and $D_i - R_i$ for dimensions and criteria are presented in Tables 9 and 10 respectively.

Step 13. Combining fuzzy weights and $E(W)$.

By using Eq. (16), the new $D_i + R_i$ and new $D_i - R_i$ are shown in Table 12 and 13.

Table 12

New $D_i + R_i$ and new $D_i - R_i$ Dimension Implementation of SHRM

SHRM	New D+R	New D-R
C_1	4.08	-0.53
C_2	3.99	0.88
C_3	3.95	-0.35

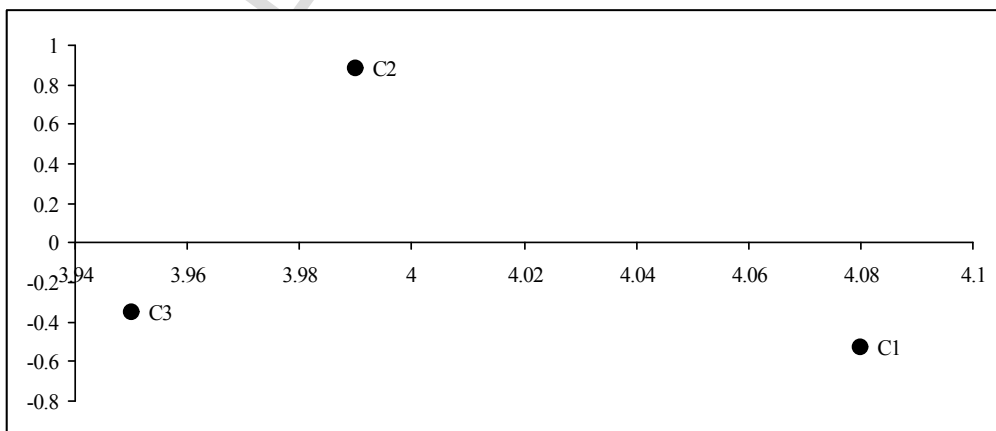
Table 13

New $D_i + R_i$ and new $D_i - R_i$ criteria of implementation of SHRM

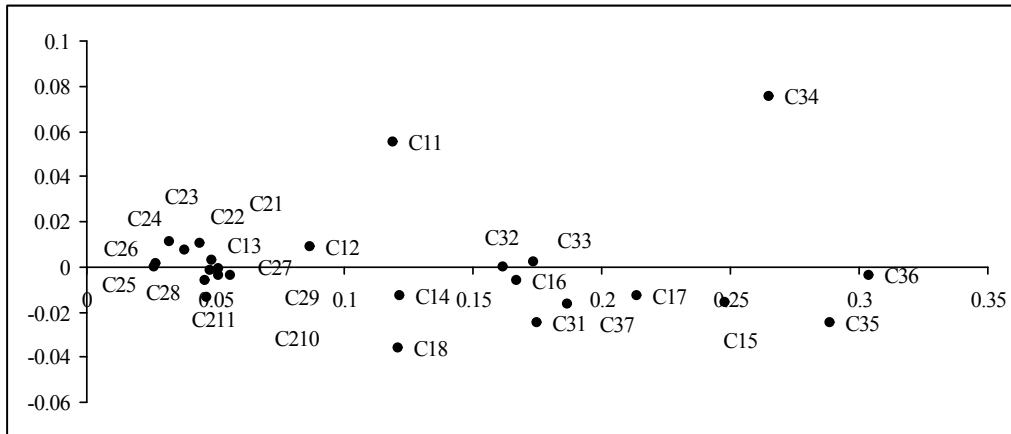
SHRM	criteria	New D+R	New D-R
C_1	c_{11}	0.119	0.055
	c_{12}	0.087	0.009
	c_{13}	0.049	0.003
	c_{14}	0.122	-0.013
	c_{15}	0.248	-0.016
	c_{16}	0.167	-0.006
	c_{17}	0.214	-0.013
	c_{18}	0.121	-0.036

C_2	c_{21}	0.032	0.011
	c_{22}	0.044	0.01
	c_{23}	0.038	0.007
	c_{24}	0.027	0.001
	c_{25}	0.047	-0.014
	c_{26}	0.026	0
	c_{27}	0.051	-0.001
	c_{28}	0.051	-0.004
	c_{29}	0.056	-0.004
	c_{210}	0.048	-0.002
	c_{211}	0.046	-0.006
C_3	c_{31}	0.175	-0.025
	c_{32}	0.162	0
	c_{33}	0.174	0.002
	c_{34}	0.265	0.075
	c_{35}	0.289	-0.025
	c_{36}	0.304	-0.004
	c_{37}	0.187	-0.017

Step 14. Design causal diagram: causal diagram for the dimensions and criteria of the success of implementation of sustainable human resources management in small and medium industries in Kerman province is presented in Figures 3 and 4.



Figures 3. Diagram of the dimensions of the implementation of SHRM



Figures 4. Diagram of the criteria of the implementation of SHRM

5. Discussion

In this paper, an integration model of fuzzy AHP and interval type-2 fuzzy DEMATEL was proposed to prioritize factors affecting the success of implementation of sustainable human resource management. The aim of this study was to modify DEMATEL results by considering the weight of different indicators and an integration model of fuzzy AHP and interval type-2 fuzzy DEMATEL was used for this purpose. However, when a study aims to determine the final weight of indicators, the AHP weight vector can be multiplied by the normalized relationship matrix to determine the final weight of indicators. After obtaining the weights of indicators using fuzzy AHP method, they are multiplied by $D+R$ and $D-R$ values obtained from interval type-2 fuzzy DEMATEL method to examine whether each dimension or indicator is a cause or effect; indicators with positive $D-R$ values are effective indicators or causes and those with negative $D-R$ values are impressive indicators or effects. On the basis of this approach, factors affecting the success of implementation of sustainable human resource management can be divided into two categories.

Based on the results obtained from interval type-2 fuzzy DEMATEL technique presented in table 2 (11), it can be stated that due to the positivity of $D-R$, the environment dimension is an

affective dimension or a cause and due to the negativity of D-R, economic and social dimensions are effects.

Regarding social dimension, indicators of social infrastructures, availability of employment opportunities and easy access to workplace — due to the positivity of D-R values — are effective indicators and realization of psychological needs, social justice, sustainable social design, sustainability of society and corporate social responsibility — due to the negativity of D-R values — are impressive indicators. Regarding social dimension, maintaining and improvement of the welfare of current and future generations must be taken into account (Chiu, 2003) and needed grounds must be provided to improve the quality of working life and also to eliminate social gaps and inequalities (Enyedi, 2002). Managers and organizations should provide needed social infrastructures to the human resources in order to enable them to access employment opportunities. Providing these conditions realizes the psychological needs of employees. In other words, finding job opportunities will reduce employee stress. By realization of these needs, employees will feel that they live in a society where social justice is a reality. As a result, social responsibility will lead organization and society towards sustainability. Regarding environment dimension, indicators of designing green jobs, green human resource planning, green recruitment, green choice and green performance evaluation— due to the positivity of D-R values — are effective indicators and implementation of greening, green education, management of green encouragement system, green health and management of personnel safety, green staff discipline management, green staff relations and human resource efficiency — due to the negativity of D-R values — are impressive indicators. Environmental human resource management acts as an infrastructural factor and pro-environment organizations must pay special attention to environmental human resource management in order to develop economic and social aspects of their human resource management. In environmental sustainability, managers attempt to create a healthy

and appropriate environment and try to reduce environmental impacts and to restore environmental damages; because moving towards sustainable development requires resolving environmental problems (Randolph, 2004). In this regard, in the selection and recruitment system, standards must be defined to avoid recruitment of employees who do not care about environment. Also, after recruiting staff, organization must develop standards to evaluate employee performance on the basis of environmental standards. After institutionalization of designing green job, green choice, green employment and green performance evaluation in an organization, organization will provide environmental protection trainings and managers should consider standards in this regard to encourage employees to perform eco-friendly measures. In this case, employee relations will also be conducted based on these eco-friendly measures. Today's organizations can implement greening by conducting these measures and can establish green health and safety management.

Regarding economic dimension, indicators of business process re-engineering and committed cost reduction strategies of senior manager — due to the positivity of D-R values — are effective indicators and economic growth through development of facilities, macroeconomic policies and guaranteed employment — due to the negativity of D-R values — are impressive indicators. Regarding this dimension, economic sustainability is achieved through saving valuable resources for future generations; this is indeed the implementation of the principle of fair and equal distribution among generations. Economic sustainability is related to cost reduction and economic advantage results from better management of resources and efficiency of processes (Munasinghe, 1993); therefore, special attention should be paid to some factors such as business process re-engineering.

6. Conclusion

Studies conducted on sustainable development suggest that there have been a growing interest towards sustainability over the past two decades and this has increased measures associated with sustainability. Numerous factors including human resource can be applied in sustainable development of organizations; however, researchers have paid less attention to this issue. The link between sustainability and human resource management and related studies has not still developed widely in all subfields of human resource management. Different interpretations of sustainability have been presented; however, human resource management has been less concerned in this regard. In this regard, the present study was conducted to create a link between human resource management and sustainability and used fuzzy AHP and interval type-2 fuzzy DEMATEL techniques to identify and rank factors affecting the implementation of sustainable human resources management.

Sustainable human resource management plays a crucial role in environmental, social and economic management. The sustainability of human resource management depends on exploring external settings for opportunities, changes, trends and available risks and creating a balance between economic, social and environmental settings. Sustainable human resource management can establish attitudes in employees and managers to stop environmental destruction. Besides environmental benefits, sustainable human resource managers save financial resources through cost reduction, macro-economic policies and business process re-engineering and they can maximize an organization's revenue through savings. These managers are concerned about maintaining and improving the welfare of current and future generations; they create a harmonious living environment and improve the quality of life and eliminate social gaps and inequalities.

This study aimed to determine the weight and the cause-effect relationships between factors affecting sustainable human resource management in small and medium-sized enterprises

(SMEs) in Kerman province; therefore, this study is geographically limited to Kerman province. In terms of study population, it is limited to SMEs. In terms of analysis techniques, fuzzy AHP and interval type-2 fuzzy DEMATEL are the only techniques used; thus, this research can be conducted in other communities, using other decision making techniques.

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